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अपकेंद्रों पम्प की विशिष्टि
भाग 1 कृषि और ग्रामीण जल आपूर्ति
के लिए प्रयोजनाएं
(चौथा पुनरीक्षण)

**Horizontal Centrifugal Pumps for
Clear, Cold Water — Specification**

Part 1 Agricultural and Rural Water
Supply Purposes
(*Fourth Revision*)

ICS 23.100.10

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FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pumps Sectional Committee had been approved by the Mechanical Engineering Divisional Council

This standard was first published in 1972 and subsequently revised in 1980, 1993 and 2002. While finalizing the second revision in 1993, the Pumps Sectional Committee decided to publish this standard in the following two parts:

- a) Part 1 Agricultural and rural water supply purposes, and
- b) Part 2 General purpose (other than agricultural and rural water supply).

After the first revision, the concept of minimum efficiency was introduced in 1982. The efficiency was raised by 5 points in 1983.

In the second revision, the efficiency for pumps was arrived at after analyzing the data collected from various sources and the values of the efficiency for the pumps were to be reviewed/ upgraded after 3 years.

In the third revision, in order to review/upgrade the efficiencies, a large data relating to pump efficiencies was collected to assess the possibility of increase in efficiency. After analyzing the data and considering the scope for increase, minimum efficiency was increased by five percent over the existing pump efficiency values and given in Fig. 1 to 4.

The fourth revision of IS 6595 (Part 1) incorporates Amendment no. 2 (May 2006) and Amendment no. 3 (March 2014). In the recent years, the demand for these pumps has decreased considerably due to depleting water table. The pump efficiency, has therefore, not been upgraded by the manufacturers. Moreover, energy-efficient submersible pump sets of all types and ratings are easily available in the market as an alternative to these pumps. On the basis of data relating to pump efficiencies collected from various sources, it has been decided not to alter the values of minimum efficiencies specified in the third revision.

The concept of minimum efficiency in this specified head range and a check on the declared value of nominal head with respect to observed head at guaranteed duty point, permissible test speed and recommended prime-mover rating have been introduced in this revision.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***HORIZONTAL CENTRIFUGAL PUMPS FOR
CLEAR, COLD WATER — SPECIFICATION****PART 1 AGRICULTURAL AND RURAL WATER
SUPPLY PURPOSES***(Fourth Revision)***1 SCOPE**

This standard (Part 1) provides the technical requirements for horizontal centrifugal pumps non self-priming type, for handling clear, cold water for agricultural and rural water supply purposes.

2 REFERENCES

The Indian Standards listed at Annex-A contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

3 UNITS AND TERMINOLOGY

For the purpose of this standard the units and terminology specified in IS 5120, and the following shall apply.

3.1 Static Water Depth

It is the depth of water level below the ground level when the pump is not in operation.

3.2 Draw Down

It is the elevation difference between the depth of static water level and the consistent standing water level in tube-well during pump in operation.

3.3 Static Suction Lift

It is the vertical distance between the centre line of horizontal portion of the suction pipe line and the water level.

3.4 Manometric Suction Lift

Manometric suction lift is the vacuum gauge/suction manometer/suction transducer reading in metre of water column during pump in operation under suction lift.

3.5 Non-Self-Priming

It is that type of centrifugal pump which cannot prime without a reflex or foot valve.

3.6 Self-Priming

It is that type of centrifugal pump which is capable of priming without a reflex or foot valve.

4 CHARACTERISTIC OF CLEAR, COLD, WATER

Clear, cold water shall mean water having the characteristics specified below:

- a) Turbidity : 50 ppm (silica scale), Max
- b) Chlorides : 500 ppm, Max
- c) Total solids : 3 000 ppm. Max
- d) pH value : 6.5 to 8.5
- e) Temperature : 33°C, Max
- f) Specific gravity : 1.004, Max
- g) Hardness : 300, Max (drinking water)

NOTE — If any other characteristics of the water differ from these specifications, the pump, constructional details shall be agreed between the manufacturer/supplier and the user. In such cases the characteristics shall be specified in the order.

5 NOMENCLATURE

Nomenclature of the parts commonly used in horizontal centrifugal pumps shall be as given in IS 5120.

6 MATERIAL OF CONSTRUCTION

6.1 There are a number of recognized materials of construction available to meet the needs of pumps handling clear, cold water. Typical material for a few components are indicated below, merely for the guidance of the manufacturer and user:

<i>Sl. No.</i>	<i>Component</i>	<i>Material of Construction</i>
(1)	(2)	(3)
i)	Volute Casing	Cast iron grade FG 200 of IS 210
ii)	Impeller	Cast iron grade FG 200 of IS 210 or Bronze grade LTB2 of IS 318

Sl. No.	Component	Material of Construction
(1)	(2)	(3)
iii)	Casing and Impeller wearing	Cast iron grade FG 200 of IS 210 or bronze grade LTB2 of IS 318 ring (if provided)
iv)	Shaft sleeve (If provided)	Bronze grade LTB2 of IS 318 or Stainless steel grades X04 Cr12, X12 Cr12 or X20 Cr13 of IS 6603 or IS 6911
v)	Shaft	Class 3 A of IS 1875
vi)	Bush	Bronze grade LTB2, 3 or 4 of IS 318 or nitrile/cutless rubber

NOTES

1 The materials listed are to be considered as only typical and indicative of minimum requirement of the material properties. The use of materials having better properties is not prejudiced by the details provided above.

2 To get benefit from advancement in technology of thermoplastic materials, such as polyphenylene oxide (PPO) polycarbonate, acetal, nylon 66, polytetrafluoroethylene (PTFE) etc, may be used for pump parts like shaft sleeves, volute casing, impeller, wearing rings, glands, etc.

3 It is recommended to use MoS₂ (molybdenum disulphide) lubricated gland packing if stainless steel shaft sleeve is used.

6.2 Gaskets, Seals and Packings

Suitable gaskets, seals and packings should be used. Material of these gaskets, seals and packings should be such that it shall not be affected by the water being pumped.

7 DIRECTION OF ROTATION

7.1 The direction of rotation of pump is designated clockwise or anticlockwise as observed when looking at the pump shaft from the driving end.

7.2 The direction of rotation shall be clearly and securely marked by incorporating an arrow on the pump.

8 DESIGN FEATURES

8.1 The pump shall have suitable features properly designed as per IS 10804 (Part 1 and 2), to ensure satisfactory performance. In particular, the design features, such as the following shall be incorporated:

- The pump shall be capable to operate without overloading the prime-mover in the specified head range. However, the head range shall not be less than +10 percent and –20 percent of guaranteed duty point head up to 20 m. Above 20 m the limits shall be from +5 percent to –20 percent of guaranteed duty point head, and
- Pump shall be capable to perform as per specified duty point at the manometric suction lift as specified in Table 1.

8.2 The minimum pump efficiency at the specified duty point shall be in accordance with Fig. 1 and 2 for speeds 1 200 to 2 000 rpm and in accordance with Fig. 3 and 4 for speeds 2 001 to 3 600 rpm.

8.3 The pump-shaft shall be of adequate size to transmit the required power over the entire range.

Table 1 Manometric Suction Lift for Various Discharge Rate Ranges and Speed Ranges at Mean Sea Level and 33 °C Water Temperature

[Clause 8.1(b)]

Manometric Suction Lift (m)	Speed Range, rpm					
	1200-1600	1601-2000	2001-2500	2501-2900	2901-3300	3301-3600
	Discharge Rate Range, l/s					
6.0	Up to 72	Up to 46	Up to 30	Up to 24	Up to 17	Up to 14
5.5	72-93	46-57	30-37	24.0-29.0	17-21	14-18
5.0	—	57-67	37-43	29.0-33.5	21-25	18-21
4.5	—	67-78	43-50	33.5-38.5	25-29	21-24
4.0	—	78-89	50-57	38.5-43.5	29-33	24-28
3.5	—	—	57-64	43.5-50.0	33-37	28-31

NOTE — While the manometric suction lift indicated above is to be maintained at specified duty point, it may not be always practicable to achieve this situation during testing. In such cases, the requirements of this clause shall be deemed to have met, if the manometric suction lift is maintained within –5 percent and +10 percent of specified discharge rate.

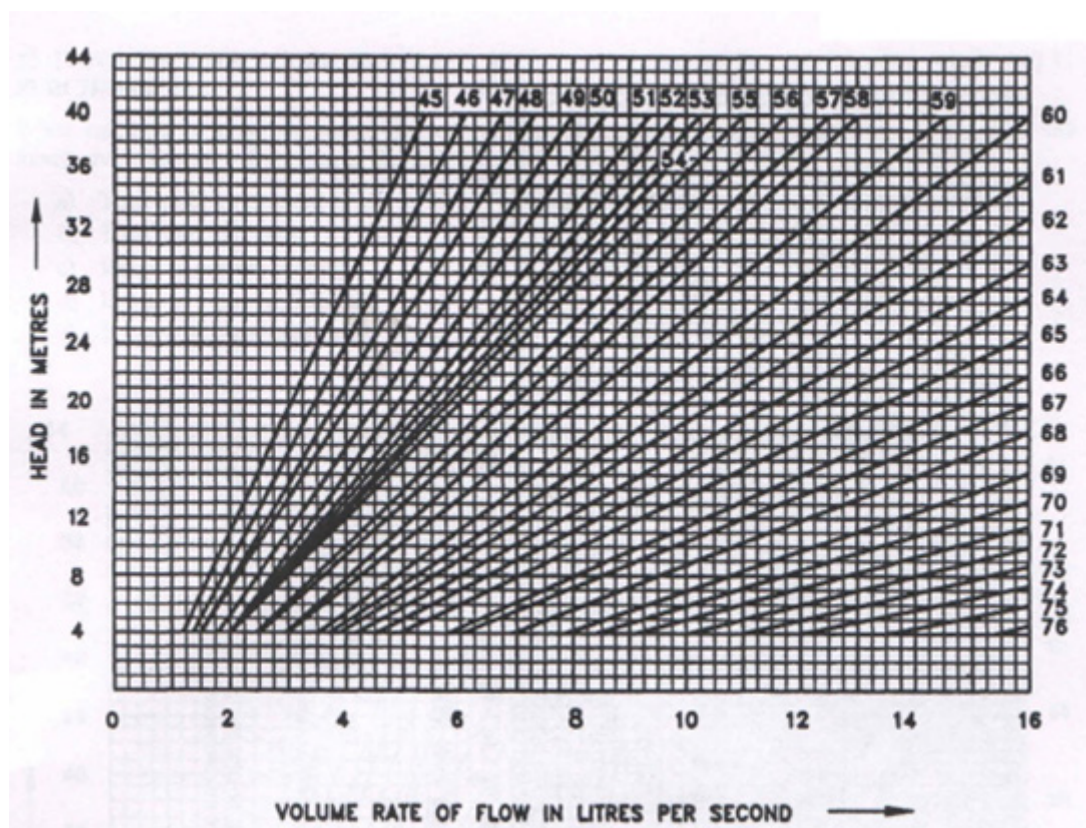


FIG. 1 MINIMUM EFFICIENCY IN PERCENT FOR HORIZONTAL CENTRIFUGAL PUMPS FOR AGRICULTURAL PURPOSES (SPEED 1200 TO 2000 RPM) (FOR VOLUME RATE OF FLOW UP TO AND INCLUDING 16 LITRE PER SECOND)

NOTES

- 1 Where the point lies in between the efficiency lines, higher value be taken as minimum efficiency.
- 2 Efficiency of the pump having declared duty point beyond the efficiency lines on either side may be declared by the manufacturer.

9 GENERAL REQUIREMENTS

9.1 Volute Casing

The volute casing shall be of robust construction and tested to withstand a hydrostatic test pressure of 1.5 times the maximum discharge pressure experienced by the pump casing for a duration of minimum 2 min.

9.2 Impeller

In case of pumps having rotational speed up to 2 000 rpm, the impeller shall be statically balanced. In case of pumps above 2 000 rpm, impeller shall be dynamically balanced as per grade G 6.3 of IS/ISO 21940-11.

NOTE — balancing here means the balancing of the imbalanced rotating mass in the impeller and not balancing of the axial hydraulic thrust in the impeller.

10 PUMP TEST

The testing of the pumps shall be in accordance with IS 11346.

11 SAMPLING

The method of sampling and criteria for conformity for acceptance of a lot offered for inspection shall be in accordance with IS 10572.

12 GUARANTEES AND TOLERANCES ON PUMP PERFORMANCE

12.1 Guarantee of Workmanship and Material

The pumps shall be guaranteed by the manufacturer against defects in material and workmanship under normal use and service either for a period of at least 15 months from the date of dispatch or 12 months from the date of commissioning whichever is earlier.

12.2 Guarantee of Performance

The pump shall be guaranteed for its performance of the nominal discharge and nominal head. The efficiency shall be guaranteed at the specified duty point only. If the customer has asked for guarantee on other points, these shall be subject to increased



- 2 Efficiency of the pump having declared duty point beyond the efficiency lines on either side may be declared by the manufacturer.

FIG. 2 MINIMUM EFFICIENCY IN PERCENT FOR HORIZONTAL CENTRIFUGAL PUMPS FOR AGRICULTURAL PURPOSES
(SPEED 1 200 TO 2 000 RPM) (FOR VOLUME RATE OF FLOW ABOVE 16 LITRES PER SECOND)

tolerances as agreed mutually. The efficiency of the pump shall not be less than those values given in Fig. 1 to 4.

NOTE — The pump shall be guaranteed at the nominal duty point. The same pump may also be deemed to have met the guarantee if, the users required duty point lies within the specified tolerances of head (± 4 percent) and discharge (± 7 percent of the nominal duty point values and also meets the non- overloading requirements.

12.2.1 The permissible tolerance on discharge, head and efficiency shall be as indicated in IS 11346

12.2.2 The power consumption by the pump in kW at its rated speed in the specified operating head range including power loss between the driving element and the pump on account of flat/v-belt drives, shall not exceed the 1.12 times of the Power Consumption of recommended prime mover rating.

12.2.3 The guarantee shall be deemed to have been met if,

- a) the measured value of head, discharge and pump efficiency are within the limits specified in IS 11346 . However after applying the tolerance, efficiency shall not be less than that derived from Fig. 1 to 4; and
- b) in the specified head range power consumption does not exceed 1.1 times of the prime mover rating .

12.2.4 Corrections and Allowances

Power delivered to the pump shaft when directly connected shall be the power output of the driving element. When not directly connected, correction shall be made for the losses between the driving element and the pump. In the case of flat belt and V-belt drives, the allowance for belt losses shall be taken as 6 and 3 percent, respectively.

12.2.5 Vibrations of the pump or combined motor-pump unit shall be given in IS/ISO 5199 : 2002. For diesel engine driven pumps, vibrations shall be limited to 25 mm/s.

12.2.6 Noise level at a distance of 1.85 m from equipment surface shall not exceed 85 dBA.

12.3 Correction in Manometric Suction Lift for Higher Altitude and Water Temperature

12.3.1 Correction for Altitude

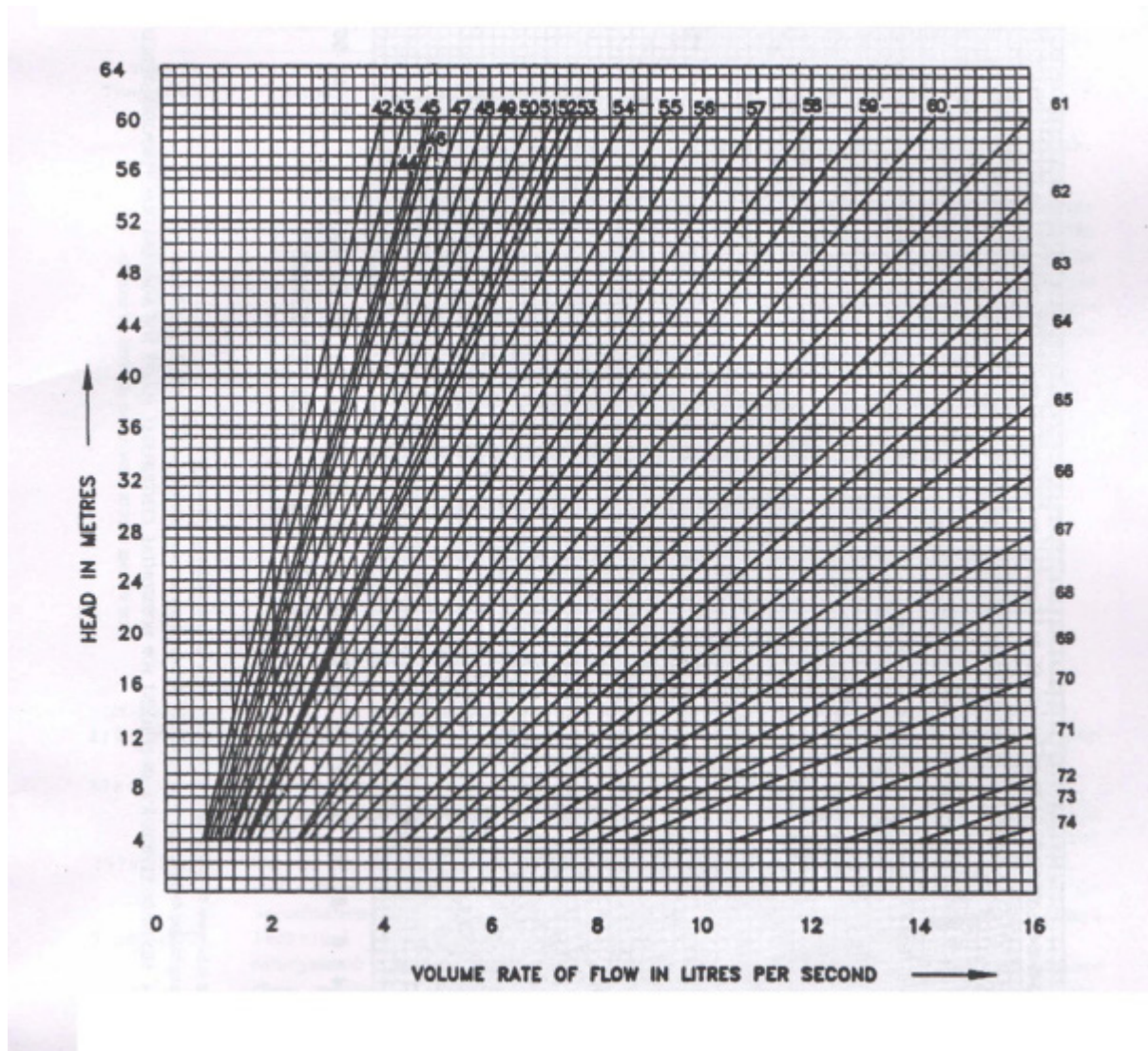
Barometric pressure should be recorded at test place. The difference between atmospheric pressure at test place and 10.33 m water column (that is, atmospheric pressure at mean sea level) shall be deducted from manometric suction lift specified in 8.1(b).

12.3.2 Correction for Temperature

Manometric suction lift specified in 8.1(b) shall be increased or decreased as given in Table 2 when water temperature is below or above 33°C.

Table 2 Correction for Temperature in Manometric Suction Lift
(Clause 11.3.2)

Sl. No.	Water Temperature °C	Vapour Pressure m	Correction in Manometric Suction Lift Above and Below 33°C Water Temperature
(1)	(2)	(3)	(4)
i)	10	0.13	+ 0.39
ii)	15	0.18	+ 0.34
iii)	20	0.24	+ 0.28
iv)	25	0.33	+ 0.19
v)	30	0.43	+ 0.09
vi)	33	0.52	+ 0.00
vii)	35	0.58	– 0.06
viii)	40	0.76	– 0.24
ix)	45	1.00	– 0.48
x)	50	1.28	– 0.76



NOTES

- 1 Where the point lies in between the efficiency lines, higher value be taken as minimum efficiency.
- 2 Efficiency of the pump having declared duty point beyond the efficiency lines on either side may be declared by the manufacturer.

FIG. 3 MINIMUM EFFICIENCY IN PERCENT FOR HORIZONTAL CENTRIFUGAL PUMPS FOR AGRICULTURAL PURPOSES (SPEED 2001 TO 3600 RPM) (FOR VOLUME RATE OF FLOW UP TO AND INCLUDING 16 LITRES PER SECOND)

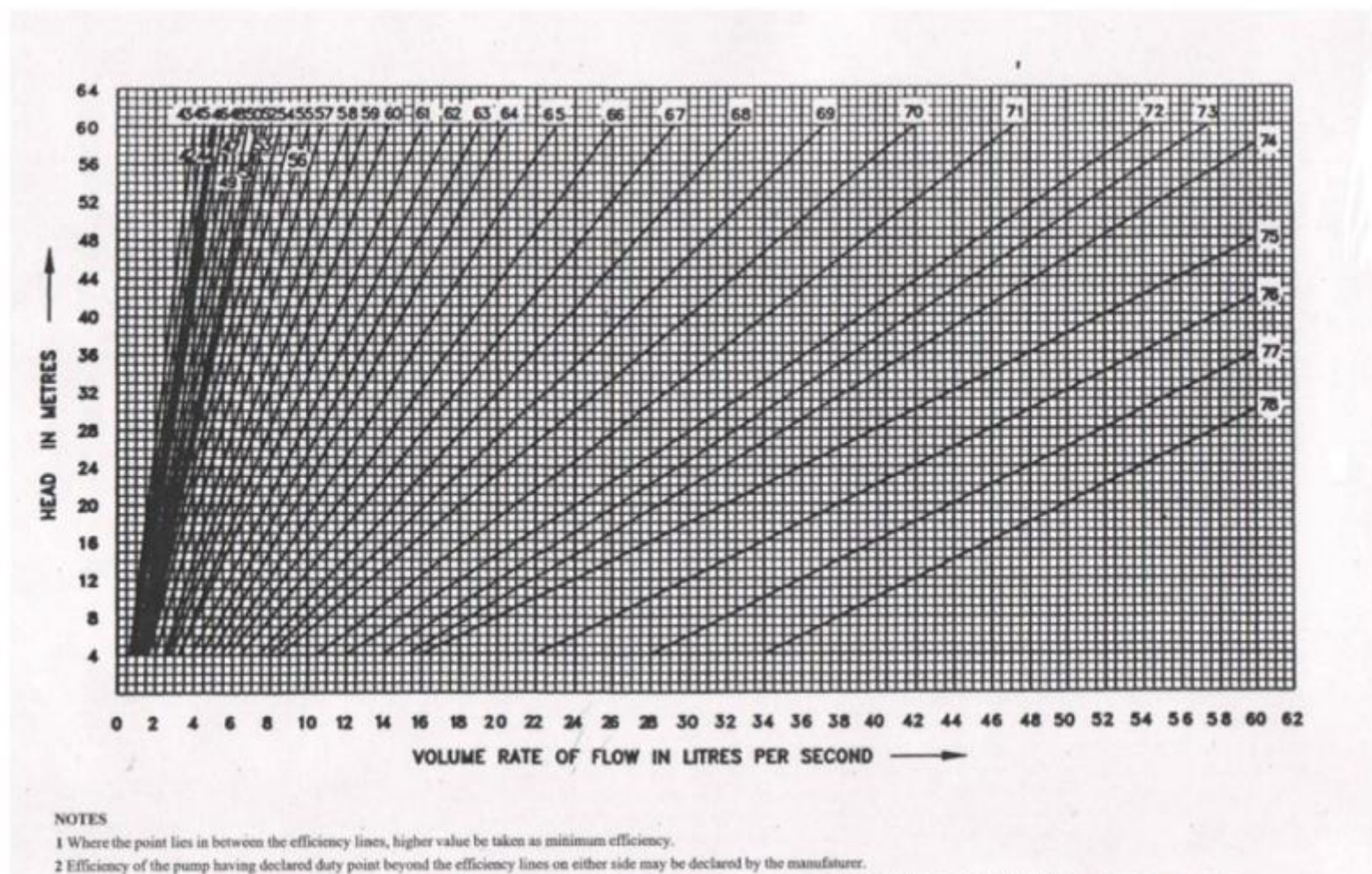


FIG. 4 MINIMUM EFFICIENCY IN PERCENT FOR HORIZONTAL CENTRIFUGAL PUMPS FOR AGRICULTURAL PURPOSES
(SPEED 2001 TO 3600 RPM) (FOR VOLUME RATE OF FLOW ABOVE 16 LITRES PER SECOND)

13 INFORMATION TO BE SUPPLIED BY PURCHASER

When inquiring or ordering pump, the user shall furnish the following information to the supplier:

- a) Total discharge required, in l/s;
- b) Total head in metre;
- c) Range of head in metre;
- d) Range of discharge in l/s; and
- e) If the total head and range of head is not known, then the following details shall be provided:
 - 1) Total static head during kharif, rabi and summer seasons, in metre;
 - 2) Suction pipe dia, in mm;
 - 3) Suction pipe length, in m;
 - 4) Delivery pipe dia, in mm;
 - 5) Delivery pipe length, in m;
 - 6) Pipe material;
 - 7) Foot valve/sluice valve/non-return valve;
 - 8) Number of bends in suction branch;
 - 9) Number of bends in delivery branch;
 - 10) Prime-mover rating. If there is any limitation of prime-mover rating; and
 - 11) If possible sketch of installation to be furnished.

14 MARKING

14.1 Pump shall be marked with the following:

- a) Manufacturer's name or registered trade-mark;
- b) Model, size (size of suction and delivery pipe nominal diameter in mm) and serial No. of pump;
- c) Rated speed, in rpm;
- d) Nominal head, in m nominal discharge, in l/s and pump efficiency, in percent at the nominal duty point;
- e) Head range, in m for non-overloading requirements;
- f) Discharge range, in l/s corresponding to the specified head range, in m;
- g) Recommended prime-mover rating, in kW; and
- h) Arrow to indicate direction of rotation.

14.2 BIS Certification Marking

The pump may also be marked with the Standard Mark.

14.2.1 The use of Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the rules and regulations made thereunder. The details of the conditions under which the licence for use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No</i>	<i>Title</i>
IS 210 : 2009	Grey iron castings — Specification
IS 318 : 1981	Specification for leaded tin bronze in gots and castings — Specification
IS 1875 : 1992	Carbon steel billets, blooms, slabs and bars f or forgings — Specification
IS 5120 : 1977	Technical requirements for roto dynamic special purpose pumps — Specification
IS 6603 : 2001	Stainless steel bars and flats — Specification
IS 6911 : 2017	Stainless steel plate, sheet and strip — Specification
IS 10572 : 1983	Methods of sampling pumps
IS 10804 (Part 1) : 2018	Recommended pumping system for agricultural purposes: Part 1 Surface pumps (<i>third revision</i>)
IS 10804 (Part 2) : 2018	Recommended pumping system for agricultural purposes: Part 2 Submersible pump sets (<i>third revision</i>)
IS 11346 : 2002	Code of acceptance tests for agricultural and water supply pumps
IS/ISO 5199 : 2002	Technical specification for centrifugal pumps — Class II
IS/ISO 21940-11 : 2016	Mechanical vibration — Rotor balance: Part 2 Procedures and tolerances for rotors with rigid behaviour

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Amendments Issued Since Publication

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